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Screening of wild *Solanum* rootstock to manage dry root rot disease (*Macrophomina phaseolina*) in brinjal

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ABSTARCT

Five wild *Solanum* species were screened against dry root rot disease in glass house condition with commonly cultivated brinjal as control. The disease was scored at different day's interval on 30th, 45th and 60th days after planting (DAP). Among the wild species screened and evaluated the species *S. torvum* was observed without any disease incidence i.e (0). The least per cent of disease incidence was observed in *S. incanum* (38.60%) which was followed by *S. xanthocarpum* (42.80%), *S. viarum* (64.20%) and CO2 (78.50 %) susceptible check at 30 DAP. Secondary metabolites were analysed from both wild and control plants. Based on the per cent disease incidence values *S. torvum* was graded as 'Resistant' against *M. phaseolina* and can be recommended as a best rootstock for brinjal under varying climatic condition especially where the dry climate prevails.

KEYWORDS: Brinjal, wild *Solanum* species, screening, dry root rot, resistance

INTRODUCTION

Eggplant, *Solanum melongena* L., is an important vegetable crop cultivated almost all parts of India and other South Asian countries [1]. This is an important vegetable with lots of nutrient values and is an excellent source of vitamins [2]. Even though eggplant is cultivated in larger area the productivity is low due to major biotic stresses *viz*., pest, disease and nematodes [3]. Adverse climatic conditions are primarily responsible for the low productivity of brinjal. Due to unfavorable climatic conditions and incidence of pest and diseases quality produce is the main contrast in reaping higher returns especially during summer production [4]. Recently much drastic change in climate especially water scarcity otherwise known as drought has led to outbreak of new disease; dry root rot of brinjal caused by *M. phaseolina*, which is nowadays becoming major threat under dry climatic condition. In the present investigation, an attempt has been made to screen wild *Solanum* rootstock to manage dry root rot disease (*Macrophomina phaseolina*) in brinjal, in comparison with cultivated variety.

MATERIALS AND METHODS

This investigation was carried out at the field research unit and glass house condition of College Orchard, Horticulture College and Research Institute, Tamil Nadu Agricultural University, Coimbatore to screen the wild *Solanum* species against dry root rot pathogen. The experiment was laid out in Randomized and Completely Randomized Block Design (RBD, CRD) with three replications. The five wild *Solanum* species *viz*., *Solanum torvum*, *S. viarum*, *S. xanthocarpum*, *S. incanum*, and *S. elaegnifolium* along with susceptible check CO 2 were artificially inoculated with the sand maize medium *M. phaseolina* cultures @ 100g per pot at 15 DAP. The plants were observed for the wilting symptoms at different day's intervals 30, 45 and 60th DAP along with the biochemicals and secondary metabolites with enzymes.

RESULT AND DISCUSSION

The result revealed that the wild *Solanum* species along with check plants screened at different days of interval *viz*., 30, 45 and 60th DAP indicated that the highest dry root rot incidence was noticed in the species *S. viarum* (68.49 %) followed by *S. elaegnifolium* (66.62 %) but the species *S. torvum* did not exhibit any dry root rot symptom (0) and it was very high in susceptible check CO 2 (74.13 %) under glass house condition (Table 1) .

The roots of wild *Solanum* species and susceptible check were analyzed for the biochemical constituents *viz*., total phenols, OD phenol content, peroxidase, polyphenol oxidase, and phenylalanine ammonia lyase activity in roots at different intervals after inoculation of pathogen and the inoculation after 21 days will be more active for enzyme activity which will exhibit the resistance mechanism (Table 2 and Figure 1).

The highest phenol was recorded in *S. torvum* (50.25 mg g^{-1} of root) followed by *S. incanum* (30.50 mg g^{-1} of root). The lowest content of phenol was recorded in the wild species *S. viarum* (16.48 mg g^{-1} root). The highest ortho-dihydroxy (OD) phenol content was recorded by the species *S. torvum* (22.54 mg g^{-1}) followed by *S. incanum* (19.20 mg g^{-1}). The lowest value was recorded by *S. viarum* (12.54 mg g^{-1}). The highest peroxidase activity was recorded in *S. torvum* 3.88 OD $min^{-1}g^{-1}$. It was closely followed by *S. incanum* (2.93 OD $min^{-1}g^{-1}$) and *S. viarum* recorded the lowest peroxidase activity of 1.60 OD $min^{-1}g^{-1}$.

The species *S. torvum* recorded the highest polyphenol oxidase activity (PPO) of 3.65 OD $min^{-1}g^{-1}$ followed by *S. incanum* (2.99 OD $min^{-1}g^{-1}$). The lowest polyphenol oxidase activity of 1.48 OD min^{-1} g^{-1} was recorded by *S. viarum*. Among the wild *Solanum* species, *S. torvum* recorded the highest PAL activity of 15.39 nmol of trans cinnmic acid min^{-1} g^{-1} and followed by *S. incanum* (12.75 nmol of trans cinnmic acid min^{-1} g^{-1}). The lowest activity was recorded in *S. viarum* (9.63 nmol of trans cinnmic acid min^{-1} g^{-1} of fresh root).

The wild species *S. torvum* could be considered as "highly resistant" species for *M. phaseolina*. As the *Solanum torvum* has good root architecture with more number of lateral roots, it could survive under dry condition and overcome the pathogen infection. Such incidence of disease indicated that the pattern of resistance found in the field was similar to that found in the pot culture condition in these *Solanum* species (Figure 2). But, the available report showed that muskmelon grafted to interspecific hybrid squash (*Cucurbita maxima* x *Cucurbita moschata*) had tolerance to *M. phaseolina* [5].

The fungus usually produces some enzymes which can break the cell wall [6]. The rootstock with higher amount of lignified cells in the roots, more number of functional roots and production of fungal cell degrading chemicals and enzymes also imparts resistance to the dry root rot pathogen.

The biochemical mechanism *viz*., phenol, OD phenol, protein, peroxidase, polyphenol oxidase and phenyalanine ammonia lyase was analyzed in the wild *Solanum* roots which was artificially inoculated with *Macrophomina* culture at different days of inoculation. The results revealed that among the five wild *Solanum* species, *S. torvum* roots recorded highest value for all the biochemical traits at different day interval. The biochemicals phenol, ortho-dihydroxy phenol and enzymes accumulated more at 21 days after inoculation and then reduced gradually, revealed that three weeks after inoculation was more favourable for pathogen attack. The resistant mechanism which involved in the production of phytoalexins and that might have resulted in inhibit of organism multiplication and proliferation inside the host. Accumulation of these biochemical traits has

Table 1: Dry root rot incidence on wild *Solanum* species under pot culture condition

Rootstock	Root rot incidence (%)		
	30* DAP	45* DAP	60* DAP
Solanum torvum	0	0	0
Solanum viarum	64.20 (53.26)	76.90 (61.30)	86.47 (68.49)
Solanum xanthocarpum	42.80 (40.86)	68.50 (55.87)	73.19 (58.83)
Solanum incanum	38.60 (38.41)	52.70 (46.54)	63.87 (53.06)
Solanum elaegnifolium	50.40 (45.23)	70.30 (56.99)	84.18 (66.62)
CO2	78.50 (62.41)	89.20 (70.94)	92.29 (74.13)

* Mean of five replications. Figures in parentheses are arc sine transformed values

Table 2: Biochemical constituents in roots of wild *Solanum* species inoculated with *Macrophomina phaseolina* (21 days after inoculation)

Treatment	Phenols (mg g^{-1})	OD phenols (mg g^{-1})	PO	PPO	PAL
S. torvum	50.25	22.54	3.88	3.65	43.86
S. viarum	16.48	12.54	1.60	1.48	13.69
S. xanthocarpum	25.46	15.45	2.56	2.87	20.02
S. incanum	30.50	19.20	2.93	2.99	36.25
S. elaegnifolium	18.41	13.62	2.49	2.24	26.25
CO2	15.40	5.24	1.08	1.38	14.29

PO - Peroxidase (changes in OD $min^{-1}g^{-1}$ of sample)
PPO - Polyphenol oxidase (changes in OD $min^{-1}g^{-1}$ of sample)
PAL - Phenylalanine ammonia lyase (nmol of trans cinnmic acid min^{-1} g^{-1} of fresh tissue

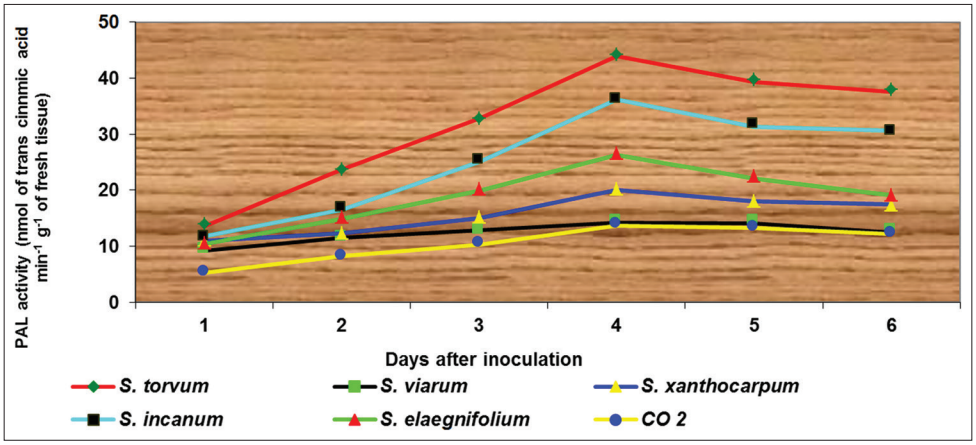

Figure 1: Phenylalanine ammonium lyase activity in dry root rot pathogen inoculated wild *Solanum* species roots

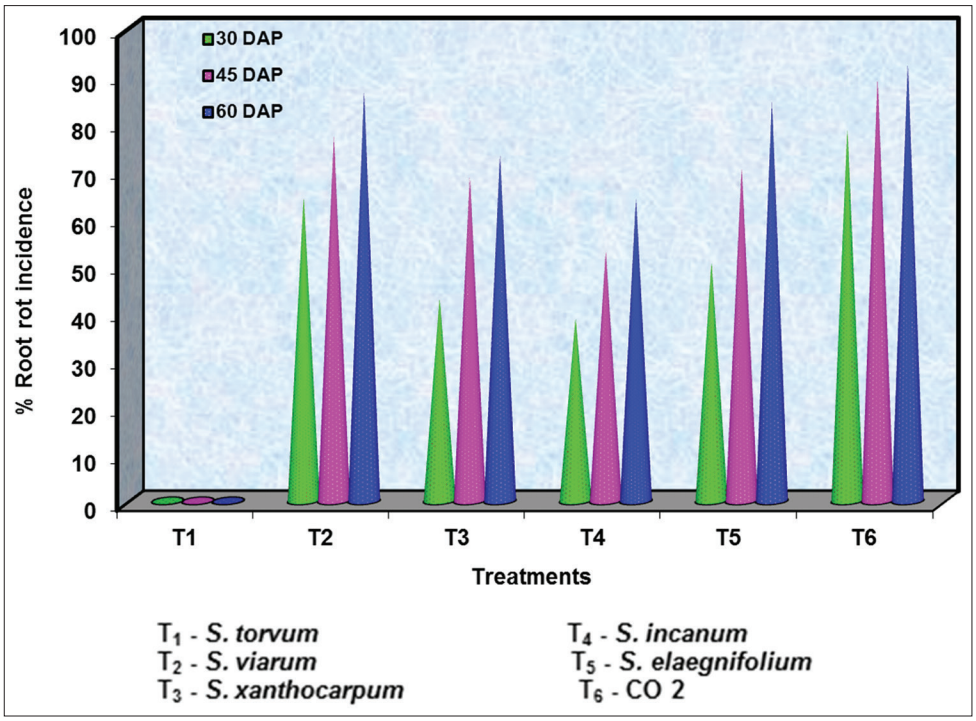

Figure 2: Percent root rot incidence in wild *Solanum* species under pot culture condition

been correlated with induced systematic resistance in several plants [7-10].

From this study it is concluded that the inoculation of wild *Solanum* species with *Macrophomina phaseolina* on 30, 45 and 60 DAP showed that *S. torvum* exhibited no symptom and manifested as resistant for dry root rot under both pot culture and field conditions similarly the grafts inoculated with *M. phaseolina* indicated that four scions with *S. torvum* as rootstock did not exhibit any symptom of root rot under pot culture and field conditions. Based on disease incidence value, *S. torvum* was adjudged as the best species to impart disease resistance against dry root rot.

The biochemical constituents in wild *Solanum* species after the inoculation of *M. phaseolina* showed that higher phenol, ortho- dihyroxy phenol content and enzymes *viz*., peroxidase, polyphenol oxidase, phenylalanine ammonia lyase were observed with wild species *S. torvum* at 21 DAI under both pot and field conditions also the biochemical analysis with respect to grafts against dry root rot pathogen under pot culture condition also shows highest readings for all chemicals and enzymes with COBH 2 on *S. torvum*. Hence, it was confirmed from the study that the wild species *Solanum torvum* could be strongly recommended as the best rootstock for eggplant propagation and production under dry climatic conditions.

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